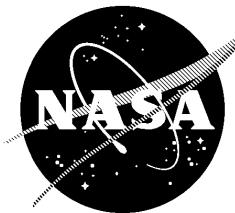


REVIEW

MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE

Earth Science Data Information System  
(ESDIS)  
Level 1 Product Generation System (LPGS)  
Output Files  
Data Format Control Book

August 1997



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REVIEW

**Earth Science Data Information System (ESDIS)  
Level 1 Product Generation System (LPGS)  
Output Files  
Data Format Control Book**

**August 1997**

Prepared Under Contract NAS5-31000/HQ001057  
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## REVIEW

# Preface

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This Data Format Control Book (DFCB) is maintained and controlled by the Level 1 Product Generation System (LPGS) Project Configuration Management Board (PCMB) and may only be updated or revised on approval by the PCMB. Comments and questions regarding this DFCB should be directed to

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## Abstract

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This Data Format Control Book (DFCB) presents detailed data formats of the output files generated by the Level 1 Product Generation System (LPGS). The LPGS produces Level 1 output files from Level 0R images based on user requests. The LPGS produces images in Hierarchical Data Format (HDF)-EOS, FAST-C, or Georeference Tagged Image File Format (GeoTIFF).

This document is based on the requirements contained in the ESDIS LPGS Functional and Performance Requirements Specification (F&PRS) and the ESDIS LPGS Operations Concept.

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Georeference Tagged Image File Format (GeoTIFF)

Level 1 Product

Earth Observing System Data and Information System (EOSDIS)

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# Section 1. Introduction

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## 1.1 Purpose

This Data Format Control Book (DFCB) defines detailed formats of the output files generated by the Level 1 (L1) Product Generation System (LPGS). The LPGS generates L1 products in response to L1 product generation requests received from the Earth Observation System Data and Information System (EOSDIS) Core System (ECS).

The LPGS output file formats described in this DFCB are based on the requirements contained in the Earth Science Data Information System (ESDIS) LPGS Functional and Performance Requirements Specification (F&PRS) (Applicable Document 1) and the ESDIS Level 1 Product Generation System (LPGS) Operations Concept (Applicable Document 2). In addition, the Hierarchical Data Format-Earth Observation Satellite (HDF-EOS) Level 1 product formats are heavily derived from the formats of the Level 0R (L0R) products, as described in the Landsat 7 System Zero-R Distribution Product Data Format Control Book, Volume 5, Book 1 (Applicable Document 4), in order to provide less impact to the user community and to provide general consistency in ECS output.

## 1.2 Scope

This DFCB describes the data contents and HDF-EOS, FAST-C Format, and Georeference Tagged Image File Format (GeoTIFF) details for the LPGS output files. The functional, performance, operational, and interface design details for the transfer of these files from the LPGS to the ECS are contained in the ECS-LPGS ICD. The contents of the LPGS output files defined in this DFCB are based on the Landsat 7 System Zer0-R Distribution Product Data Format Control Book, Volume 5, Book 1, and already established FAST-C and GeoTIFF standards. Current EOSAT Landsat products are in the FAST-B format, new EOSAT products will be in FAST-C format, and other remote sensed images, from platforms such as SPOT, are in GeoTIFF.

The file formats contained in this DFCB are applicable to the interface between the ECS and the LPGS. This DFCB does not contain specific details on the file formats of the products distributed by ECS to the customer. Detailed formats for the Level 1 products will be defined in future documentation.

## 1.3 Intended Users

This document is intended as a supplement to the Interface Control Document (ICD) Between the EOSDIS Core System (ECS) and the ESDIS Level 1 Product Generation System (LPGS) (Applicable Document 3). Therefore, the LPGS and the EOSDIS projects are the primary users of this document, with the user community as the secondary user of this document. This document contains detailed information on the LPGS output data file formats to allow users on both sides to proceed with independent development of the LPGS and ECS systems.

This DFCB provides detailed information on the contents of the LPGS output files associated with the L1 processed image. The primary intention of the data formats contained in this DFCB is to support the development of the direct interface between the LPGS and the ECS.

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### 1.4 Definitions

1. Level 0R (L0R) digital image: Spatially reformatted, demultiplexed, and unrectified subinterval data
2. L0R product: The L0R digital image plus radiometric, calibration, attitude, and ephemeris data in HDF-EOS unencapsulated format. The L0R product consists of the following files:
  - L0R digital image
  - Internal calibrator (IC) data--Calibration data file containing all the calibration data received on a major frame basis for a given subinterval
  - Mirror scan correction data (MSCD)--Scan direction and error information for a given subinterval
  - Payload correction data (PCD)--Information on spacecraft attitude and ephemeris, including quality indicators for each subinterval
  - Metadata--Descriptive information about the L0 digital image and names of appended files associated with the image
  - Calibration parameter file (CPF)--Formatted file containing gains, biases, and offsets for the instrument and detectors
3. Level 1R (L1R) digital image: Radiometrically corrected but not geometrically resampled.
4. Level 1R (L1R) product L1 product packaged by the LPGS and distributed by ECS to the customer consisting of the following in HDF-EOS format:
  - L1R digital image
  - IC data--Calibration data file containing all the calibration data received on a major frame basis for a given subinterval
  - Consensus MSCD--Scan direction and error information for a given subinterval
  - Consensus PCD--Information on spacecraft attitude and ephemeris, including quality indicators for each subinterval
  - Metadata--Descriptive information about the L1 digital image and names of appended files associated with the image
  - Calibration parameter file--Formatted file containing gains, biases, and offsets for the instrument and detectors
  - Geolocation table--Scene corner coordinates and scan line numbers
5. Level 1G (L1G) digital image: Radiometrically corrected and resampled for geometric correction and registration to geographic map projections.
6. Level 1G (L1G) product L1 product packaged by the LPGS and distributed by the ECS to the customer; includes, for all requested bands, FAST-C or GeoTIFF format L1G image and associated data accommodated by the format; HDF format L1G image and metadata
7. Interval: The time duration between the start and stop of an imaging operation (observation) of the Landsat 7 Enhanced Thematic Mapper Plus (ETM+) instrument

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8. Subinterval: Segment of time corresponding to a portion of an observation within a single Landsat 7 contact period
9. Worldwide Reference System (WRS) scene: Digital image that covers an area equivalent to one of the 57,784 scene centers (233 paths by 248 rows areas) defined by the WRS structure

## Section 2. Documentation

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The following documents provide additional detail and reference information regarding the format of the LPGS output files.

### 2.1 Applicable Documents

1. National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center (GSFC)/Missions Operations and Data Systems Directorate (MO&DSD), Earth Science Data Information System (ESDIS) Landsat 7 Level 1 Product Generation System (LPGS) Functional and Performance Requirements Specification, 510-FPD/0196, February 1997
2. --, Level 1 Product Generation System (LPGS) Operations Concept, 510-3OCD/0196, March 1997 (CSC 10034093)
3. --, Interface Control Document (ICD) Between the Earth Observation Satellite Data and Information System (EOSDIS) Core System (ECS) and the Level 1 Product Generation System (LPGS), Draft, April 1997
4. --, Landsat 7 System, Zero-R Distribution Product Data Format Control Book, Volume 5, Book 1, 430-11-06-007-0, May 23, 1997
5. --, Image Assessment System (IAS) Calibration Parameter File Definition, 430-15-01-002-0, June 1997
6. --, Earth Sciences Data and Information System (ESDIS) Project Mission-Specific Requirements for the Landsat 7 Mission Level 1 Processing, 505-10-36, December 1996
7. <http://www.earthlink.net/~ritter/geotiff/geotiff.html>
8. [http://www.spaceimage.com/home/pubs/tech\\_papers/index.html](http://www.spaceimage.com/home/pubs/tech_papers/index.html)
9. Jet Propulsion Laboratory, California Institute of Technology, Planetary Data System Standards Reference, Chapter 12, Object Description Language Specification and Usage, Version 3.2, July 24, 1995  
<http://pds.jpl.nasa.gov/stdref/chap12.htm>

## Section 3. LPGS Output Files Overview

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The L1R digital image is very similar to the L0R digital image, except that the image data are radiometrically corrected. In addition, the format 1 and format 2 PCD and MSCD files are all combined into one consensus file. The consensus file is a single file created from the two original files included with the L0R product with errors corrected. The L1R product is available in HDF-EOS only. The L1G digital image is geometrically corrected and is available in three format options: HDF-EOS, FAST-C, or GeoTIFF.

Tables 3-1 through 3-3 detail the L1 product components for each format.

**Table 3-1. HDF-EOS Product Components**

Component	L1R	L1G
L1 digital image (for each requested band)	X	X
Calibration parameter file	X	
Scan line offsets - format 1 (for bands 1through 6 low)	X	
Scan line offsets - format 2 (for bands 6 high through 8)	X	
PCD (consensus)	X	
MSCD (consensus)	X	
Metadata (LPS) - format 1	X	
Metadata (LPS) - format 2	X	
Metadata (LPGS)	X	X
Internal calibrator data - format 1 (for bands 1through 6 low)	X	
Internal calibrator data - format 2 (for bands 6 high through 8)	X	
Geolocation table	X	

**Table 3-2. FAST-C Product Components**

Component	L1G
Header file	X
L1 Digital image (for each requested band)	X

**Table 3-3. GeoTIFF Product Components**

Component	L1G
File (contains both image data and metadata)	X

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### 3.1 FAST-C

In a FAST-C format product, the term volume has traditionally referred to tape. However, in the context of LPGS products, it will refer to on-line electronic storage, which assumes a single volume. Only the L1G product is available in this format.

#### 3.1.1 Header File

The first file that should be read is a read-me-first file that contains header data in American Standard Code for Information Interchange (ASCII). Alphanumeric fields are left-justified and numeric fields are right-justified. Dates are given in American National Standards Institute (ANSI) full year, month, and day-of-month format. All processing options and map projection information for the product are also contained in this file.

#### 3.1.2 Image File

Each image file contains only one ETM+ band of image pixels. There are no header records within the image file, nor are there prefix and/or suffix data in the individual image records. Image data are unblocked. The image files are 8-bit unsigned integers.

### 3.2 GeoTIFF

GeoTIFF defines a set of public domain TIFF tags that describe all cartographic and geodetic information associated with geographic TIFF imagery. GeoTIFF is a means for tying a raster image to a known model space or map projection and for describing those projections. A metadata format provides geographic information to associate with the image data, but the TIFF file structure allows both the metadata and the image data to be encoded into the same file. The TIFF file is 8-bit unsigned integers.

### 3.3 HDF-EOS

Both the L1R and the L1G products can be ordered in HDF-EOS.

#### 3.3.1 Image File

Each requested image band is self-contained in a single file. The file format is described in the L0R DFCB, Volume 5 (Applicable Document 4). The L1R image files will be in absolute units scaled to 16 bits. The L1G images will be 8-bit unsigned integers scaled, if necessary, to fit within this range.

#### 3.3.2 Ancillary Data

The remaining files included with the HDF-EOS product include the internal calibrator (IC) data, scan line offsets, mirror scan correction data (MSCD), payload correction data (PCD), calibration parameter file (CPF), geolocation table, and metadata. See Table 3-1 for a complete listing of which files are included with each product. These files are described in detail in Section 4.

## Section 4. LPGS Output File Formats

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### 4.1 FAST-C File Formats

#### 4.1.1 Header File

The header file contains three 1536-byte ASCII records. The first record is the Administrative Record, which contains information that identifies the product, the image, and the data specifically needed to ingest the imagery. In order to import the image data, it is necessary to read entries in the Administrative Record.

The second record is the Radiometric Record, which contains the coefficients needed to convert the image digital values into at-satellite spectral radiance.

The third record is the Geometric Record, which contains the image geodetic location information. In order to align the imagery to other data sources, it will be necessary to read entries in the Geometric Record.

Tables 4-1, 4-2, and 4-3 describe the formats of the three records, including the number of bytes, the FORTRAN format statement, and a brief description of each field. The FORTRAN format statements refer to the following:

A = character data

D = double precision data

F = floating data

All N/A fields are zero filled.

**Table 4-1. Administrative Record (1 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	12	A12	"REQUESTbIDb="
	2	13	23	A11	Request number in TBD format
	3	24	34	A11	"bLOCATIONb="
	4	35	51	A17	First image location path/row/fraction/subscene in ppp/rrrrffss format
	5	52	70	A19	"bACQUISITIONbDATEb="
	6	71	78	A8	First image acquisition date in yyyyddmm format
	7	79	79	1X	Blank fill
	8	80	80	A1	Carriage return
	9	81	91	A11	"SATELLITEb="
	10	92	101	A10	First image satellite Name: LANDSAT7
	11	102	110	A9	"bSENSORb="
	12	111	120	A10	First image sensor Name: ETMPLUS

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**Table 4-1. Administrative Record (2 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
	13	121	134	A14	"bSENSORbMODEb="
	14	135	140	A6	First image sensor Mode: NORMAL
	15	141	153	A13	"bLOOKbANGLEb="
	16	154	159	F6.2	First image off-nadir angle in degrees: 0.0
	17	160	160	A1	Carriage return
3	18	161	183	23X	Blank fill
	19	184	194	A11	"bLOCATIONb="
	20	195	211	A17	Second image location path/row/fraction/subscene in ppp/rrrrfss format
	21	212	230	A19	"bACQUISITIONbDATEb="
	22	231	238	A8	Second image acquisition date in yyyyddmm format
	23	239	239	1X	Blank fill
	24	240	240	A1	Carriage return
4	25	241	251	A11	"SATELLITEb="
	26	252	261	A10	Second image satellite Name: LANDSAT7
	27	262	270	A9	"bSENSORb="
	28	271	280	A10	Second image sensor Name: ETMPLUS
	29	281	294	A14	"bSENSORbMODEb="
	30	295	300	A6	Second image sensor Mode: NORMAL
	31	301	313	A13	"bLOOKbANGLEb="
	32	314	319	F6.2	Second image off-nadir angle in degrees: 0.0
	33	320	320	A1	Carriage return
5	34	321	343	23X	Blank fill
	35	344	354	A11	"bLOCATIONb="
	36	355	371	A17	Third image location path/row/fraction/subscene in ppp/rrrrfss format
	37	372	390	A19	"bACQUISITIONbDATEb="
	38	391	398	A8	Third image acquisition date in yyyyddmm format
	39	399	399	1X	Blank fill
	40	400	400	A1	Carriage return
6	41	401	411	A11	"SATELLITEb="
	42	412	421	A10	Third image satellite Name: LANDSAT7
	43	422	430	A9	"bSENSORb="
	44	431	440	A10	Third image sensor Name: ETMPLUS
	45	441	454	A14	"bSENSORbMODEb="
	46	455	460	A6	Third image sensor Mode: NORMAL
	47	461	473	A13	"bLOOKbANGLEb="
	48	474	479	F6.2	Third image off-nadir angle in degrees: 0.0
	49	480	480	A1	Carriage return
7	50	481	503	23X	Blank fill
	51	504	514	A11	"bLOCATIONb="
	52	515	531	A17	Fourth image location path/row/fraction/subscene in ppp/rrrrfss format

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**Table 4-1. Administrative Record (3 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
	53	532	550	A19	"bACQUISITIONbDATEb="
	54	551	558	A8	Fourth image acquisition date in yyyyddmm format
	55	559	559	1X	Blank fill
	56	560	560	A1	Carriage return
8	57	561	571	A11	"SATELLITEb="
	58	572	581	A10	Fourth image satellite Name: LANDSAT7
	59	582	590	A9	"bSENSORb="
	60	591	600	A10	Fourth image sensor Name: ETMPLUS
	61	601	614	A14	"bSENSORbMODEb="
	62	615	620	A6	Fourth image sensor Mode: NORMAL
	63	621	633	A13	"bLOOKbANGLEb="
	64	634	639	F6.2	Fourth image off-nadir angle in degrees: 0.0
	65	640	640	A1	Carriage return
9	66	641	654	A14	"PRODUCTbTYPEb="
	67	655	672	A18	Product type: 'MAPbORIENTEDbbbbbb' , 'ORBITbORIENTEDbbbb'
	68	673	687	A15	"bPRODUCTbSIZEb="
	69	688	697	A10	Product size: 'FULLbSCENE' , 'SUBSCENEbb' , 'MULTISCENE'
	70	698	719	22X	blank fill
	71	720	720	A1	Carriage return
10	72	721	740	A20	"TYPEbOFbPROCESSINGb="
	73	741	751	A11	Type of processing used: 'SYSTEMATICb' ,
	74	752	764	A13	"bRESAMPLINGb="
	75	765	766	A2	Resampling algorithm used: 'CC' , 'NN' , 'MF'
	76	767	799	33X	blank fill
	77	800	800	A1	Carriage return
11	78	801	819	A19	"VOLUMEb##bINbSETb="
	79	820	821	I2	Tape volume number in tape set (for multi-volume image). - N/A
	80	822	822	A1	"/"
	81	823	824	I2	Number of volumes in tape set (for multi-volume image). - N/A
	82	825	842	A18	"bPIXELSbPERbLINEb="
	83	843	847	I5	Number of pixels per image line for 30-meter band
	84	848	864	A17	"bLINESbPERbBANDb="
	85	865	869	I5	Number of lines per 30-meter band
	86	870	870	A1	"/"
	87	871	875	I5	Number of lines in the output image
	88	876	879	4X	blank fill
	89	880	880	A1	Carriage return

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**Table 4-1. Administrative Record (4 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
12	90	881	894	A14	"STARTbLINEb#b="
	91	895	899	I5	First image line number on this volume (for multi-volume image) - N/A
	92	900	917	A18	"bBLOCKINGbFACTORb="
	93	918	919	I2	Tape blocking factor - N/A
	94	920	935	A16	"bRECORDbLENGTHb="
	95	936	940	I5	Length of physical file record in bytes per 30-meter band
	96	941	953	A13	"bPIXELbSIZEb="
	97	954	959	F6.2	Pixel size in meters for 30-meter band
	98	960	960	A1	Carriage return
13	99	961	983	A23	"OUTPUTbBITSbPERbPIXELb="
	100	984	985	I2	Output bits per pixel: 8
	101	986	1011	A26	"bACQUIREDbBITSbPERbPIXELb="
	102	1012	1013	I2	Acquired bits per pixel: 8
	103	1014	1039	26X	blank fill
	104	1040	1040	A1	Carriage return
14	105	1041	1055	A15	"BANDSbPRESENTb="
	106	1056	1087	A32	Image bands present on this volume
	107	1088	1119	32X	blank fill
	108	1120	1120	A1	Carriage return
15	109	1121	1199	79X	blank fill
	110	1200	1200	A1	Carriage return
16	111	1201	1279	79X	blank fill
	112	1280	1280	A1	Carriage return
17	113	1281	1359	79X	blank fill
	114	1360	1360	A1	Carriage return
18	115	1361	1439	79X	blank fill
	116	1440	1440	A1	Carriage return
19	117	1441	1519	79X	blank fill
	118	1520	1520	A1	Carriage return
20	119	1521	1535	15X	"REVbbbbbbbbbb"
	120	1536	1536	A1	Format version code - C.

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**Table 4-2. Radiometric Record (1 of 2)**

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	50	A50	"BIASESbANDbGAINSbINbTHE bBANDbORDERb"
	2	51	79	29X	Blank fill
	3	80	80	A1	Carriage Return
2	4	81	104	D24.15	Bias for Band 1
	5	105	105	1X	Blank fill
	6	106	129	D24.15	Gain for Band 1
	7	130	159	30X	Blank fill
	8	160	160	A1	Carriage Return
3	9	161	184	D24.15	Bias for Band 2
	10	185	185	1X	Blank fill
	11	186	209	D24.15	Gain for Band 2
	12	210	239	30X	Blank fill
	13	240	240	A1	Carriage Return
4	14	241	264	D24.15	Bias for Band 3
	15	265	265	1X	Blank fill
	16	266	289	D24.15	Gain for Band 3
	17	290	319	30X	Blank fill
	18	320	320	A1	Carriage Return
5	19	321	344	D24.15	Bias for Band 4
	20	345	345	1X	Blank fill
	21	346	369	D24.15	Gain for Band 4
	22	370	399	30X	Blank fill
	23	400	400	A1	Carriage Return
6	24	401	424	D24.15	Bias for Band 5
	25	425	425	1X	Blank fill
	26	426	449	D24.15	Gain for Band 5
	27	450	479	30X	Blank fill
	28	480	480	A1	Carriage Return
7	29	481	504	D24.15	Bias for Band 6L
	30	505	505	1X	Blank fill
	31	506	529	D24.15	Gain for Band 6L
	32	530	559	30X	Blank fill
	33	560	560	A1	Carriage Return
8	34	561	584	D24.15	Bias for Band 6H
	35	585	585	1X	Blank fill
	36	586	609	D24.15	Gain for Band 6H
	37	610	639	30X	Blank fill
	38	640	640	A1	Carriage Return
9	39	641	664	D24.15	Bias for Band 7
	40	665	665	1X	Blank fill
	41	666	689	D24.15	Gain for Band 7
	42	690	719	30X	Blank fill
	43	720	720	A1	Carriage Return

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**Table 4-2. Radiometric Record (2 of 2)**

Line	Field	Start Byte	End Byte	Format	Description
10	44	721	744	D24.15	Bias for Band 8
	45	745	745	1X	Blank fill
	46	746	769	D24.15	Gain for Band 8
	47	770	799	30X	Blank fill
	48	800	800	A1	Carriage Return
11	49	801	879	79X	Blank fill
	50	880	880	A1	Carriage Return
12	51	881	959	79X	Blank fill
	52	960	960	A1	Carriage Return
13	53	961	1039	79X	Blank fill
	54	1040	1040	A1	Carriage Return
14	55	1041	1119	79X	Blank fill
	56	1120	1120	A1	Carriage Return
15	57	1121	1199	79X	Blank fill
	58	1200	1200	A1	Carriage Return
16	59	1201	1279	79X	Blank fill
	60	1280	1280	A1	Carriage Return
17	61	1281	1359	79X	Blank fill
	62	1360	1360	A1	Carriage Return
18	63	1361	1439	79X	Blank fill
	64	1440	1440	A1	Carriage Return
19	65	1441	1519	79X	Blank fill
	66	1520	1520	A1	Carriage Return
20	67	1521	1535	15X	Blank fill
	68	1536	1536	A1	Carriage Return

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**Table 4-3. Geometric Record (1 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	14	A14	"GEOMETRICbDATA"
	2	15	31	A17	"bMAPbPROJECTIONb="
	3	32	35	A4	Map projection name (see Appendix A for list of mnemonics)
	4	36	47	A12	"bELLIPSOIDb="
	5	48	65	A18	Earth ellipsoid used - WGS_84
	6	66	73	A8	"bDATUMb="
	7	74	79	A6	Datum name - WGS84
	8	80	80	A1	Carriage Return
2	9	81	108	A28	"USGSbPROJECTIONbPARAMETERSb="
	10	109	109	1X	Blank fill
	11	110	133	D24.15	USGS projection parameter #1:Semi-major axis
	12	134	134	1X	Blank fill
	13	135	158	D24.15	USGS projection parameter #2:Semi-minor axis
	14	159	159	1X	Blank fill
	15	160	160	A1	Carriage Return
3	16	161	184	D24.15	USGS projection parameter #3
	17	185	185	1X	Blank fill
	18	186	209	D24.15	USGS projection parameter #4
	19	210	210	1X	Blank fill
	20	211	234	D24.15	USGS projection parameter #5
	21	235	239	5X	Blank fill
	22	240	240	A1	Carriage Return
4	23	241	264	D24.15	USGS projection parameter #6
	24	265	265	1X	Blank fill
	25	266	289	D24.15	USGS projection parameter #7
	26	290	290	1X	Blank fill
	27	291	314	D24.15	USGS projection parameter #8
	28	315	319	5X	Blank fill
	29	320	320	A1	Carriage Return
5	30	321	344	D24.15	USGS projection parameter #9
	31	345	345	1X	Blank fill
	32	346	369	D24.15	USGS projection parameter #10
	33	370	370	1X	Blank fill
	34	371	394	D24.15	USGS projection parameter #11
	35	395	399	5X	Blank fill
	36	400	400	A1	Carriage Return
6	37	401	424	D24.15	USGS projection parameter #12
	38	425	425	1X	Blank fill
	39	426	449	D24.15	USGS projection parameter #13
	40	450	450	1X	Blank fill
	41	451	474	D24.15	USGS projection parameter #14

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**Table 4-3. Geometric Record (2 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
	42	475	479	5X	Blank fill
	43	480	480	A1	Carriage Return
7	44	481	504	D24.15	USGS projection parameter #15
	45	505	559	55X	Blank fill
	46	560	560	A1	Carriage Return
8	47	561	564	A4	"ULb="
	48	565	565	1X	Blank fill
	49	566	578	A13	Geodetic Longitude of Upper Left corner of image. As per FIPS PUB 70, longitude will be expressed as degrees, minutes, seconds. Example: 5 degrees, 15 minutes, 13.2 seconds west of the prime meridian will be expressed as "0051513.2000W"
	50	579	579	1X	Blank fill
	51	580	591	A12	Geodetic Latitude of Upper Left corner of image. As per FIPS PUB 70, latitude will be expressed as degrees, minutes, seconds. Example: 9 degrees, 4 minutes, 24.2334 seconds north of the equator will be expressed as "090424.2334N"
	52	592	592	1X	Blank fill
	53	593	605	F13.3	Easting of Upper Left corner of image in projection units
	54	606	606	1X	Blank fill
	55	607	619	F13.3	Northing of Upper Left corner of image in projection units
	56	620	639	20X	Blank fill
	57	640	640	A1	Carriage Return
9	58	641	644	A4	"URb="
	59	645	645	1X	Blank fill
	60	646	658	A13	Geodetic Longitude of Upper Right corner of image
	61	659	659	1X	Blank fill
	62	660	671	A12	Geodetic Latitude of Upper Right corner of image
	63	672	672	1X	Blank fill
	64	673	685	F13.3	Easting of Upper Right corner of image in projection units
	65	686	686	1X	Blank fill
	66	687	699	F13.3	Northing of Upper Right corner of image in projection units
	67	700	719	20X	Blank fill
	68	720	720	A1	Carriage Return
10	69	721	724	A4	"LRb="
	70	725	725	1X	Blank fill
	71	726	738	A13	Geodetic Longitude of Lower Right corner of image
	72	739	739	1X	Blank fill
	73	740	751	A12	Geodetic Latitude of Lower Right corner of image
	74	752	752	1X	Blank fill
	75	753	765	F13.3	Easting of Lower Right corner of image in projection units
	76	766	766	1X	Blank fill
	77	767	779	F13.3	Northing of Lower Right corner of image in projection units

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**Table 4-3. Geometric Record (3 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
	78	780	799	20X	Blank fill
	79	800	800	A1	Carriage Return
11	80	801	804	A4	"LLb="
	81	805	805	1X	Blank fill
	82	806	818	A13	Geodetic Longitude of Lower Left corner of image
	83	819	819	1X	Blank fill
	84	820	831	A12	Geodetic Latitude of Lower Left corner of image
	85	832	832	1X	Blank fill
	86	833	845	F13.3	Easting of Lower Left corner of image in projection units
	87	846	846	1X	Blank fill
	88	847	859	F13.3	Northing of Lower Left corner of image in projection units
	89	860	879	20X	Blank fill
	90	880	880	A1	Carriage Return
12	91	881	888	A8	"CENTERb="
	92	889	889	1X	Blank fill
	93	890	902	A13	Image center geodetic longitude expressed in degrees, minutes, seconds as above. This is the true center of the full scene from which the product image was made, and does not necessarily fall inside the product image.
	94	903	903	1X	Blank fill
	95	904	915	A12	Image center geodetic latitude expressed in degrees, minutes, seconds as above. This is the true center of the full scene from which the product image was made, and does not necessarily fall inside the product image.
	96	916	916	1X	Blank fill
	97	917	929	F13.3	Image center Easting in projection units
	98	930	930	1X	Blank fill
	99	931	943	F13.3	Image center Northing in projection units
	100	944	944	1X	Blank fill
	101	945	949	I5	Image center pixel number measured from the product upper left corner, rounded to nearest whole pixel (may be negative)
	102	950	950	1X	Blank fill
	103	951	955	I5	Image center line number measured from the product upper left corner, rounded to nearest whole pixel (may be negative)
	104	956	959	4X	Blank fill
	105	960	960	A1	Carriage Return
13	106	961	968	A8	"OFFSETb="
	107	969	974	I6	Horizontal offset of the true image from the nominal scene center in units of whole pixels. (May be negative)
	108	975	994	20A	"bORIENTATIONbANGLEb="
	109	995	1000	F6.2	Orientation angle in degrees (may be negative)
	110	1001	1039	39X	Blank fill
	111	1040	1040	A1	Carriage return

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**Table 4-3. Geometric Record (4 of 4)**

Line	Field	Start Byte	End Byte	Format	Description
14	112	1041	1061	21A	"SUNbELEVATIONbANGLEb=
	113	1062	1065	F4.1	Sun elevation angle in degrees at image center
	114	1066	1085	A20	"bSUNbAZIMUTHbANGLEb=
	115	1086	1090	F5.1	Sun azimuth in degrees at image center
	116	1091	1119	29X	Blank fill
	117	1120	1120	A1	Carriage Return
15	118	1121	1199	79X	Blank fill
	119	1200	1200	A1	Carriage Return
16	120	1201	1279	79X	Blank fill
	121	1280	1280	A1	Carriage Return
17	122	1281	1359	79X	Blank fill
	123	1360	1360	A1	Carriage Return
18	124	1361	1439	79X	Blank fill
	125	1440	1440	A1	Carriage Return
19	126	1441	1519	79X	Blank fill
	127	1520	1520	A1	Carriage Return
20	128	1521	1535	79X	Blank fill
	129	1536	1536	A1	Carriage Return

Fields 79, 81, 91, and 93 of the Administrative Record refer to products on tape and are therefore not applicable to the Level 1 products produced by the LPGS.

Field 106 of the Administrative Record is the Bands Present field. It is necessary to count the number of non-blank entries in the Bands Present field to get the count of the number of bands. Each character (byte) in this field will have an ASCII character with the band label, usually a number. For ETM+, the values are 1, 2, 3, 4, 5, 6 (low), 6 (high), 7, and 8. The sequence terminates in a blank.

### 4.1.2 Image File

Each requested image band is self-contained in a single file.

## 4.2 GeoTIFF File Formats

The TIFF tags are in the same file as the TIFF image. The tag conveys information about the image. It is TIFF's version of metadata. The tags describe the image with information the TIFF reader needs to know in order to control the appearance of the image on the user's screen.

A complete description of the raster data requires georeferencing of the data. This is accomplished through the use of tags. For most common applications, the transformation raster and model space may be defined with a set of raster-to-model tiepoints and scaling parameters. The following tags may be used for this purpose.

ModelTiepointTag:

Tag = 33922

Type = DOUBLE

N = 6\*K, K = number of tiepoints

Alias: GeoreferenceTag

Owner: Intergraph

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This tag stores the raster -> model tiepoint pairs in the order:

ModelTiepointTag = (... , I, J, K, X, Y, Z...),

where (I, J, K) is the point at location (I, J) in raster space with pixel-value K, and (X, Y, Z) is a vector in model space.

A raster image may be georeferenced simply by specifying its location, size, and orientation in the model coordinate space. Since the relationship between the raster space and the model space will often be an exact, affine transformation, however, the relationship can be defined using one set of tiepoints and the ModelPixelScaleTag, which gives the vertical and horizontal raster grid cell size.

The next two tags are optional tags provided for defining exact affine transformations between raster and model space; baseline GeoTIFF files may use either, but shall never use both within the same TIFF image directory.

ModelPixelScaleTag:

Tag = 33550

Type = DOUBLE

N = 3

Owner: SoftDesk

This tag may be used to specify the size of raster pixel spacing in the model space units, when the raster space can be embedded in the model space coordinate system without rotation, and consists of the following 3 values:

ModelPixelScaleTag = (ScaleX, ScaleY, ScaleZ)

where ScaleX and ScaleY give the horizontal and vertical spacing of raster pixels. The ScaleZ is primarily used to map the pixel value of a digital elevation model into the correct Z-scale.

A single tiepoint in the ModelTiepointTag, together with the ModelPixelScaleTag, completely determine the relationship between raster and model space.

The ModelPixelScaleTag must not be used if the raster image requires rotation or shearing to place it into the standard model space. In these cases, the transformation shall be defined with the ModelTransformationTag.

ModelTransformationTag:

Tag = 34264

Type = DOUBLE

N = 16

Owner: JPL Cartographic Applications Group

This tag may be used to specify the transformation matrix between the raster space and the model space.

## 4.3 HDF-EOS File Formats

### 4.3.1 Image Files

Each band in the requested product is contained in a separate file. The L1R image is radiometrically corrected but not geometrically resampled. The L1G image is radiometrically corrected and resampled for geometric correction and registration to geographic map projections.

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### 4.3.2 Internal Calibrator (IC) Data Files

The IC data files are included with the L1R output product only and are described in the Landsat 7 System Zero-R Distribution Product DFCB, Volume 5. The IC data format 1 file will be provided with products that include bands 1 through 6 low image data, and the format 2 file will be provided with products that include bands 6 high through 8. These data will be subsetted to correspond to the user-requested product.

### 4.3.3 Scan Line Offsets

The scan line offsets are included with the L1R product only and are described in the Landsat 7 System Zero-R Distribution Product DFCB, Volume 5. The scan line offsets format 1 file will be provided with products that include bands 1 through 6 low image data, and the format 2 file will be provided with products that include bands 6 high through 8. These data will be subsetted to correspond to the user-requested product.

### 4.3.4 Mirror Scan Correction Data (MSCD) File

The MSCD data file is included with the L1R output product only and is described in the Landsat 7 System Zero-R Distribution Product DFCB, Volume 5. One consensus MSCD file will be provided. A consensus MSCD file is a single MSCD file, created from the two original files included with the L0R product, with errors corrected according to LPGS processing algorithms. These data will be subsetted to correspond to the user-requested product.

### 4.3.5 Payload Correction Data (PCD) File

The PCD data file is included with the L1R output product only and is described in the Landsat 7 System Zero-R Distribution Product DFCB, Volume 5. One consensus PCD file will be provided. A consensus PCD file is a single PCD file, created from the two original files included with the L0R product, with errors corrected according to LPGS processing algorithms. This consensus PCD file will not be subsetted.

### 4.3.6 Calibration Parameter File (CPF)

The CPF is a formatted file containing radiometric and geometric processing parameters required for level 1 processing. It is provided with the L1R product only without modification from what was provided with the L0R product. The format is described in the Landsat 7 System Zero-R Distribution Product DFCB, Volume 5, and the IAS Calibration Parameter File Definition (Reference 5).

### 4.3.7 Metadata File (LPS)

The LPS metadata file is included with the L1R output product without modification from what was provided from the ECS. The file format is described in the Landsat 7 System Zero-R Distribution Product DFCB, Volume 5. The metadata format 1 and format 2 files will be provided with all L1R products.

Some information in the LPS metadata file pertains to parent subintervals of the LPGS product and may not be applicable to Level 1 products produced by the LPGS.

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### 4.3.8 Metadata File (LPGS)

The LPGS metadata file is created during product generation and contains information specific to the product ordered. Table 4-4 lists the full contents of the LPGS metadata file. This file contains all applicable image coordinate information from the ECS metadata provided with the L0R product.

**Table 4-4. LPGS Metadata File (1 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	18	=LPGS_METADATA_FILE	Beginning of the first level object description language (ODL) group. It indicates the start of the LPGS Metadata File Level Group.
GROUP	18	=METADATA_FILE_INFO	Beginning of metadata file information group
REQUEST_ID	20	TBS	Unique product generation request ID generated by ECS
PRODUCT_CREATION_TIME	20	=YYYY-MM-DDThh:mm:ssZ where YYYY=four digit Julian year MM=month number of a Julian year (01-12) DD=day of a Julian month (01-31) T indicates the start of time information in the ODL ASCII time code format hh=hours (00-23) mm=minutes (00-59) ss=seconds (00-59) Z indicates “Zulu” time (same as GMT)	The LPGS system date and time when the metadata file for a Level 1 product set was created. For ease of human readability, this date and time is presented in the ODL ASCII format. The time is expressed as Universal Coordinated Time (also known as Greenwich Mean Time (GMT)).  Insertion of additional characters “T” and “Z” is required to meet the ODL ASCII format.
STATION_ID	3	=‘EDC’	Unique 3 letter code identifying the originating ground station
END_GROUP	18	=METADATA_FILE_INFO	End of the metadata information group
GROUP	16	=PRODUCT_METADATA	Beginning of the product metadata group
PRODUCT_TYPE	3	=NNN, where NNN=L1G or L1R	Identifier to tell the user the product type
SPACECRAFT_ID	8	=Landsat7	Name of the satellite platform
SENSOR_ID	4	=ETM+	Name of the imaging sensor

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**Table 4-4. LPGS Metadata File (2 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
ACQUISITION_DATE	20	=YYYY-MM-DDThh:mm:ssZ	Date the image was acquired
WRS_PATH	3	=NNN, where NNN=path number	WRS path value for the product
STARTING_ROW	3	=NNN where NNN=row of the first full or partial scene in the product	Starting WRS row
ENDING_ROW	3	=NNN where NNN=row of the last full or partial scene in the product	Ending WRS row
BAND_COMBINATION	9	=NNNNNNNNN where NNNNNNNNN=e.g. 123456678 for all bands present, 123----8 for bands 1,2,3,8. A ‘-’ is a position holder for absent bands	LPGS generated bands present indicator for the product ordered. The first 6 is format 1 band 6. The second 6 is format 2 band 6.
PRODUCT_UL_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude A negative (-) value indicates South latitude	LPGS calculated “actual” latitude value for the upper left corner of the product.
PRODUCT_UL_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive (+) value indicates East longitude A negative (-) value indicates West longitude	LPGS calculated “actual” longitude value for the upper left corner of the product.
PRODUCT_UR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision)	LPGS calculated “actual” latitude value for the upper right corner of the product.
PRODUCT_UR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision)	LPGS calculated “actual” longitude value for the upper right corner of the product.
PRODUCT_LL_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision)	LPGS calculated “actual” latitude value for the lower left corner of the product.

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**Table 4-4. LPGS Metadata File (3 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
PRODUCT_LL_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision)	LPGS calculated “actual” longitude value for the lower left corner of the product.
PRODUCT_LR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision)	LPGS calculated “actual” latitude value for the lower right corner of the product.
PRODUCT_LR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision)	LPGS calculated “actual” longitude value for the lower right corner of the product.
BAND1_FILE_NAME	26	“L7XsssfnYYDOYHHuuv_B10.xxx” where L7= Landsat 7 mission; X=1, 2, or 3 for the L7 X-band used to downlink data to the LGS; sss=ground station; f=ETM+ data format (1 or 2) (Data not pertaining to a specific format defaults to 1); n=LPS processor number (1-9); YY=last two digits of the year associated with a contact period; DOY=Julian day of the contact period; HH=hour of the contact period within a 24-hour day (00-23); uu=subinterval number within this contact period (00-99); v=dataset version number (0 for original or 1-9 for reprocessed data); and xxx=L1R or L1G	LPGS generated external element file name for band 1
BAND2_FILE_NAME	26	“L7XsssfnYYDOYHHuuv_B20.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 2
BAND3_FILE_NAME	26	“L7XsssfnYYDOYHHuuv_B30.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 3

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**Table 4-4. LPGS Metadata File (4 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND4_FILE_NAME	26	“L7XssfnYYDOYHHuuv_B40.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 4
BAND5_FILE_NAME	26	“L7XssfnYYDOYHHuuv_B50.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 5
BAND6L_FILE_NAME	26	“L7XssfnYYDOYHHuuv_B61.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 6, format 1
BAND6H_FILE_NAME	26	“L7XssfnYYDOYHHuuv_B62.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 6, format 2
BAND7_FILE_NAME	26	“L7XssfnYYDOYHHuuv_B70.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 7
BAND8_FILE_NAME	26	“L7XssfnYYDOYHHuuv_B80.xxx” where xxx=L1R or L1G	LPGS generated external element file name for band 8
IC_DATA_F1_FILE_NAME	32	“L7XssfnYYDOYHHuuv_CAL.YYDOYHHMM” where YYDOYHHMM=system clock time the product was created	ECS generated external element file name for format 1 internal calibrator data (1R product only)
IC_DATA_F2_FILE_NAME	32	“L7XssfnYYDOYHHuuv_CAL.YYDOYHHMM”	ECS generated external element file name for format 2 internal calibrator data (1R product only)
SCAN_SHIFTS_F1_FILE_NAME	32	“L7XssfnYYDOYHHuuv_SLO.YYDOYHHMM”	ECS generated external element file name for format 1 scan line shifts (1R product only)
SCAN_SHIFTS_F2_FILE_NAME	32	“L7XssfnYYDOYHHuuv_SLO.YYDOYHHMM”	ECS generated external element file name for format 2 scan line shifts (1R product only)

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**Table 4-4. LPGS Metadata File (5 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
MSCD_FILE_NAME	26	“L7XssfnYYDOYHHuv_ MSD.xxx” where xxx=L1R or L1G	LPGS generated external element file name for “consensus” MSCD (1R product only)
PCD_FILE_NAME	26	“L7XssfnYYDOYHHuv_ PCD.xxx” where xxx=L1R or L1G	LPGS generated external element file name for “consensus” PCD (1R product only)
METADATA_LPS1_FILE_NAME	32	“L7XssfnYYDOYHHuv_ MTA.YYDOYHHMM”	ECS generated external element file name for LPS format 1 metadata (1R product only)
METADATA_LPS2_FILE_NAME	32	“L7XssfnYYDOYHHuv_ MTA.YYDOYHHMM”	ECS generated external element file name for LPS format 2 metadata(1R product only)
METADATA_LPGS_FILE_NAME	26	“L7XssfnYYDOYHHuv_ MTL.xxx” where xxx=L1R or L1G	LPGS generated external element file name for LPGS metadata
CPF_FILE_NAME	26	“L7CPF.YYYYMMDD_Y YYYYMMDD.nn” where YYYYMMDD=effective start date and effective end date, respectively nn=incrementing number for within a quarter (01-99)	ECS generated external element file name for IAS Calibration Parameter File (1R product only)
GEOLOCATION_FILE_NAME	32	“L7XssfnYYDOYHHuv_ GEO.YYDOYHHMM”	ECS generated external element file name for the geolocation table (1R product only)
HDF_DIR_FILE_NAME	26	“L7XssfnYYDOYHHuv_ HDF.xxx” where xxx=L1R or L1G	LPGS generated file name for the HDF directory file
END_GROUP	16	=PRODUCT_METADATA	End of the product metadata group
GROUP	18	=PRODUCT_PARAMETERS	Beginning of the product parameters group (both 1R and 1G products)

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**Table 4-4. LPGS Metadata File (6 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
CALIBRATION_METHOD	3	=NNN, where NNN =one of the following calibratin methods: CPF Gains (CPF), internal calibrator gains (ICG)	The calibration method used by LPGS in creating the image
MAX_DETECTED_RADIANCE_LEVEL_BAND1	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND1	16	TBS	Minimum detectable radiance value for the first band
MAX_DETECTED_RADIANCE_LEVEL_BAND2	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND2	16	TBS	Minimum detectable radiance value for the first band
MAX_DETECTED_RADIANCE_LEVEL_BAND3	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND3	16	TBS	Minimum detectable radiance value for the first band
MAX_DETECTED_RADIANCE_LEVEL_BAND4	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND4	16	TBS	Minimum detectable radiance value for the first band
MAX_DETECTED_RADIANCE_LEVEL_BAND5	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND5	16	TBS	Minimum detectable radiance value for the first band
MAX_DETECTED_RADIANCE_LEVEL_BAND6L	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND6L	16	TBS	Minimum detectable radiance value for the first band
MAX_DETECTED_RADIANCE_LEVEL_BAND6H	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND6H	16	TBS	Minimum detectable radiance value for the first band
MAX_DETECTED_RADIANCE_LEVEL_BAND7	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND7	16	TBS	Minimum detectable radiance value for the first band

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**Table 4-4. LPGS Metadata File (7 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
MAX_DETECTED_RADIANCE_LEVEL_BAND8	16	TBS	Maximum detectable radiance value for the first band
MIN_DETECTED_RADIANCE_LEVEL_BAND8	16	TBS	Minimum detectable radiance value for the first band
BAND1_GAIN	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND2_GAIN	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND3_GAIN	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND4_GAIN	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND5_GAIN	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND6_GAIN1	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND6_GAIN2	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND7_GAIN	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
BAND8_GAIN	1	=“L” for low or “H” for high	Gain state for band 1’s first data line if part of the product
SUN_AZIMUTH	8	= 0.0000 through 360.0000 degrees (with a 4-digit precision)	Sun azimuth angle in degrees for the image center location at the image center acquisition time
SUN_ELEVATION	8	= 0.0000 through 360.0000 degrees (with a 4-digit precision)	Sun elevation angle in degrees for the image center location at the image center acquisition time
OUTPUT_FORMAT	7	=HDF-EOS, FAST-C, or GeoTIFF	Output format of the image
END_GROUP	18	=PRODUCT_PARAMETERS	End of the product parameters group

## REVIEW

**Table 4-4. LPGS Metadata File (8 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	19	=CORRECTIONS_APPLIED	Beginning of the corrections applied group
STRIPING	1	=N, where N=Y or N	Indicator of whether the image was corrected for striping
BANDING	1	=N, where N=Y or N	Indicator of whether the image was corrected for banding
COHERENT_NOISE	1	=N, where N=Y or N	Indicator of whether the image was corrected for coherent noise
MEMORY_EFFECT	1	=N, where N=Y or N	Indicator of whether the image was corrected for memory effect
SCAN_CORRELATED_SHIFT	1	=N, where N=Y or N	Indicator of whether the image was corrected for scan correlated shift
INOPERABLE_DETECTORS	1	=N, where N=Y or N	Indicator of whether the image was corrected for inoperable detectors
SATURATED_DETECTORS	1	=N, where N=Y or N	Indicator of whether the image was corrected for saturated detectors
DROPPED_LINES	1	=N, where N=Y or N	Indicator of whether the image was corrected for dropped lines
END_GROUP	19	=CORRECTIONS_APPLIED	End of the corrections applied group
GROUP	21	=PROJECTION_PARAMETERS	Beginning of the projection parameters group (1G product only)
REFERENCE_DATUM	5	=WGS84	Datum used by LPGS in creating the image
REFERENCE_ELLIPSOID	6	=WGS_84	Ellipsoid used by LPGS in creating the image
GRID_CELL_SIZE	21	=15 through 60 meters for each of the 3 bands in the following order: pan, reflective, thermal	Size of the grid cell used by LPGS in creating the image for each band
ORIENTATION	3	=NNN, where NNN=one of the following orientations: nominal path (NOM), North up (NUP)	The orientation used by LPGS in creating the image

## REVIEW

**Table 4-4. LPGS Metadata File (9 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
RESAMPLING_OPTION	4	=NNN, where NNN=one of the following resampling methods: nearest neighbor (NN), cubic convolution (CC), modulation transfer function compensation (MTFC)	The resampling option used by LPGS in creating the image
MAP_PROJECTION	3	=NNN, where NNN=one of the following map projections: space oblique mercator (SOM), universal transverse mercator (UTM), Lambert conformal conic (LCC), transverse mercator (TM), oblique mercator (OM), polyconic (PC), polar stereographic (PS)	The map projection used by LPGS in creating the image
END_GROUP	21	=PROJECTION_PARAMETERS	End of the projection parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of LCC
GROUP	14	LCC_PARAMETERS	Beginning of the LCC parameters group
LATITUDE_OF_FIRST_STANDARD_PARALLEL	11	-90.0 to +90.0	The latitude of first standard parallel
LATITUDE_OF_SECOND_STANDARD_PARALLEL	11	-90.0 to +90.0	The latitude of second standard parallel
LONGITUDE_OF_CENTRAL_MERIDIAN	12	-180.0 to +180.0	The longitude of central meridian
LATITUDE_OF_PROJECTION_ORIGIN	11	-90.0 to +90.0	The latitude of projection origin
FALSE_EASTING	16	$-1.0 \times 10^4$ to $+1.0 \times 10^4$	False easting
FALSE_NORTHING	16	$-1.0 \times 10^4$ to $+1.0 \times 10^4$	False northing
END_GROUP	14	LCC_PARAMETERS	End of the LCC parameters group

## REVIEW

**Table 4-4. LPGS Metadata File (10 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of TM
GROUP	13	TM_PARAMETERS	Beginning of the TM parameters group
SCALE_FACTOR_AT_CENT RAL_MERIDIAN	11	0.0 to 2.0	The scale factor at the central meridian
LONGITUDE_OF_CENTRAL MERIDIAN	12	-180.0 to +180.0	The longitude of central meridian
LATITUDE_OF_PROJECTIO N_ORIGIN	11	-90.0 to +90.0	The latitude of projection origin
FALSE_EASTING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False easting
FALSE_NORTHING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False northing
END_GROUP	13	TM_PARAMETERS	End of the TM parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of PC
GROUP	13	PC_PARAMETERS	Beginning of the PC parameters group
LONGITUDE_OF_CENTRAL MERIDIAN	12	-180.0 to +180.0	The longitude of central meridian
LATITUDE_OF_PROJECTIO N_ORIGIN	11	-90.0 to +90.0	The latitude of projection origin
FALSE_EASTING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False easting
FALSE_NORTHING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False northing
END_GROUP	13	PC_PARAMETERS	End of the PC parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of PS
GROUP	13	PS_PARAMETERS	Beginning of the PS parameters group
VERTICAL_LONGITUDE_FR OM_POLE	12	-180.0 to +180.0	The vertical longitude from pole
STANDARD_PARALLEL	11	-90.0 to +90.0	The standard parallel.
SCALE_FACTOR_AT_PROJE CTION_ORIGIN	9	0.0 to 2.0	The scale factor at the projection origin.

## REVIEW

**Table 4-4. LPGS Metadata File (11 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
FALSE_EASTING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False easting
FALSE_NORTHING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False northing
END_GROUP	13	PS_PARAMETERS	End of the PS parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of OM
GROUP	13	OM_PARAMETERS	Beginning of the OM parameters group
SCALE_FACTOR_AT_CENTER_OF_PROJECTION	9	0.0 to 2.0	The scale factor at center of projection
LATITUDE_OF_PROJECTION_ORIGIN	11	-90.0 to +90.0	The latitude of projection origin
FALSE_EASTING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False easting
FALSE_NORTHING	16	-1.0x10 <sup>4</sup> to +1.0x10 <sup>4</sup>	False northing
OM_TYPE	1	=N, where N=A or B	Value used to indicate the type of OM projection
END_GROUP	13	OM_PARAMETERS	End of the OM parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of OMA
GROUP	14	OMA_PARAMETERS	Beginning of the OMA parameters group
LONGITUDE_FIRST_POINT_GEODETIC	12	-180.0 to +180.0	The longitude of first point defining central geodetic line of projection
LATITUDE_FIRST_POINT_GEODETIC	11	-90.0 to +90.0	The latitude of first point defining central geodetic line of projection
LONGITUDE_SECOND_POINT_GEODETIC	12	-180.0 to +180.0	The longitude of second point defining central geodetic line of projection
LATITUDE_SECOND_POINT_GEODETIC	11	-90.0 to +90.0	The latitude of second point defining central geodetic line of projection
END_GROUP	14	OMA_PARAMETERS	End of the OMA parameters group

## REVIEW

**Table 4-4. LPGS Metadata File (12 of 12)**

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of OMB
GROUP	14	OMB_PARAMETERS	Beginning of the OMB parameters group
ANGLE_OF_AZIMUTH	12	-180.0 to +180.0	Angle of azimuth east of north for central line of projection
LONGITUDE_ALONG_PROJECTION	12	-180.0 to +180.0	Longitude of point along central line of projection at which angle of azimuth is measured
END_GROUP	14	OMB_PARAMETERS	End of the OMB parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are only included with products that select a map projection of UTM
GROUP	14	UTM_PARAMETERS	Beginning of the UTM parameters group
ZONE_NUMBER	2	=1 to 60	Value used to indicate the zone number
END_GROUP	13	UTM_PARAMETERS	End of the UTM parameters group
END_GROUP	14	LPGS_METADATA_FILE	End of the LPGS Metadata file level group

### 4.3.9 Geolocation Index File

The geolocation index file contains scene corner coordinates and their product-specific scan line numbers and is included with the L1R product only. The format of this file is described in the Landsat 7 System Zero-R Distribution Product DFCB, Volume 5.

## Appendix A. Projection Parameters

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This appendix contains the map projections used in the LPGS 1G products and the USGS Projection Parameters contained in the FAST-C Geometric Record. This list of map projections shows the name and the identifier used in Record 3, Field 3, of the FAST-C header file.

Projection Name	Mnemonic
Universal Transverse Mercator	UTM
Lambert's Conformal Conic	LCC
Polar Stereographic	PS
Polyconic	PC
Transverse Mercator (Gauss-Krueger)	TM
Oblique Mercator (Type A & B)	OM
Space Oblique Mercator	SOM

### USGS Projection Parameters

Projection Transformation Package Projection Parameters Elements 1-8

Code & Projection ID	Array Element							
	1	2	3	4	5	6	7	8
UTM	Lon/Z	Lat/Z						
Lambert Conformal C	SMajor	SMinor	STDPR1	STDPR2	CentMer	OriginLat	FE	FN
Polar Stereographic	SMajor	SMinor			LongPol	TrueScal e	FE	FN
Polyconic	SMajor	SMinor			CentMer	OriginLat	FE	FN
Transverse Mercator	SMajor	SMinor	Factor		CentMer	OriginLat	FE	FN
Hotin Oblique Merc A	SMajor	SMinor	Factor			OriginLat	FE	FN
Hotin Oblique Merc B	SMajor	SMinor	Factor	AziAng	AzmthPt	OriginLat	FE	FN
Space Oblique Merc B	SMajor	SMinor	Satnum	Path			FE	FN

## REVIEW

Projection Transformation Package Projection Parameters Elements 9-15

Code & Projection ID	Array Element				
	9	10	11	12	13
UTM					
Lambert Conformal C					
Polar Stereographic					
Polyconic					
Transverse Mercator					
Hotin Oblique Merc A	Long1	Lat1	Long2	Lat2	zero
Hotin Oblique Merc B					one
Space Oblique Merc B					one

where

Lon/Z	Longitude of any point in the UTM zone or zero. If zero, a zone code must be specified.
Lat/Z	Latitude of any point in the UTM zone or zero. If zero, a zone code must be specified.
SMajor	Semi-major axis of ellipsoid. If zero, Clarke 1866 in meters is assumed.
SMinor	Eccentricity squared of the ellipsoid if less than zero. If zero, a spherical form is assumed, or if greater than zero, the semi-major axis of ellipsoid.
STDPR1	Latitude of the first standard parallel
STDPR2	Latitude of the second standard parallel
CentMer	Longitude of the central meridian
OriginLat	Latitude of the projection origin
FE	False easting in the same units as the semi-major axis
FN	False northing in the same units as the semi-major axis
TrueScale	Latitude of true scale
LongPol	Longitude down below pole of map
Factor	Scale factor at central meridian (Transverse Mercator) or center of projection (Hotline Oblique Mercator)
Long1	Longitude of first point on center line (Hotine Oblique Mercator, format A)
Long2	Longitude of second point on center line (Hotine Oblique Mercator, format A)
Lat1	Latitude of first point on center line (Hotine Oblique Mercator, format A)
Lat2	Latitude of second point on center line (Hotine Oblique Mercator, format A)
Satnum	Landsat Satellite Number (SOM , format B)
Path	Landsat Path Number (Use WRS-1 for Landsat 1, 2, and 3 and WRS-2 for Landsat 4, 5, 6, or 7) (SOM , format B)

### NOTES

Array elements 14 and 15 are set to zero.

All array elements with blank fields are set to zero.

All angles (latitudes, longitudes, azimuths, etc.) are entered in packed degrees/minutes/seconds  
(DDDDMMSSSS.SS) format.

## Abbreviations and Acronyms

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ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
CPF	calibration parameter file
DAAC	Distributed Active Archive Center
DCN	document change notice
DFCB	data format control book
ECS	EOSDIS Core System
EDC	EROS Data Center
EOS	Earth Observation System
EOSAT	Earth Observation Satellite Company
EOSDIS	EOS Data and Information System
EROS	Earth Resources Observation System
ESDIS	Earth Science Data Information System
ETM+	Enhanced Thematic Mapper plus
F&PS	Functional and Performance Requirements Specification
GeoTIFF	Georeference Tagged Image File Format
GMT	Greenwich Mean Time
GSFC	Goddard Space Flight Center
HDF	hierarchical data format
IAS	Image Assessment System
IC	internal calibrator
ICD	interface control document
L1	Level 1
LPGS	Level 1 Product Generation System
LPS	Landsat Processing System
MO&DSD	Mission Operations and Data Systems Directorate
MSCD	mirror scan correction data

## REVIEW

NASA	National Aeronautics and Space Administration
ODL	object description language
PCD	payload correction data
PCMB	Project Configuration Management Board
TBD	to be defined/determined
TBR	to be resolved
TBS	to be supplied
WRS	Worldwide Reference System
0R	zero R data
Zulu	Greenwich Mean Time